International

Color Consortium ®

Document

ICC.1A:1999-04

Addendum 2 to Spec. ICC.1:1998-09

NOTE: This document supersedes and subsumes Document ICC.1A:1999-02, *Addendum 1 to Spec ICC.1:1998-09*

0 Introduction

This document is an addendum to Specification ICC.1, *File Format for Color Profiles.*

The Operating Procedures of the International Color Consortium require a ballot and a vote to approve any change to an ICC Specification. Groups of approved ballots are rolled into updated specifications at somewhat regular intervals. However, ICC rules state that each ballot becomes official as soon as it is approved. The wording of some of the ballots does not always lend itself to rapid incorporation into a specification. Consequently, this document provides a mechanism to publish recently approved ballots in a timely fashion.

The new requirements presented here use the same text as the ballots. The next revision of ICC.1 will incorporate all of these changes, with editorial revisions made where necessary.

1 Additional Requirements for Spec. ICC.1

1.1 New Attribute Bits

This is from ballot #199805, effective 1998-09-23.
Profiles conforming to these rules use a Profile Version number of 2.2.0 or greater (see ICC.1:1998-09, clause 6.1.3).

Add to Table 17 (6.1.10 Attributes):

Positive (off) or negative (on) media	Bit Position 2
Color (off) or black & white (on) media	Bit Position 3

After Table 17, add the following text:

Note that bits 0, 1, 2, and 3 describe the media, not the device. For example, a profile for a color scanner that has been loaded with black & white film will have bit 3 set on, regardless of the colorspace of the scanner (clause 6.1.5).

If the media is not inherently "color" or "black & white" (such as paper in an inkjet printer), the media takes on the property of the device. Thus, an inkjet printer loaded with a color ink cartridge can be thought to have "color" media.

1.2 Clarification of Scaling for LutTypes

This is from ballot #199806, effective 1998-10-22.
Profiles conforming to these rules use a Profile Version number of 2.2.0 or greater (see ICC.1:1998-09, clause 6.1.3).

Add the following to clause 6.5.6 (lut16Type tag):

The input, output, and grid tables contained in a lut16Type each embodies a one or multi-dimensional function which maps an input value in the "domain" of the function to an output value in the "range" of the function.

The domain of each of these tables is defined to consist of all real numbers between 0.0 and 65535.0, inclusive. The first entry is located at 0.0, the last entry at 65535.0, and intermediate entries are uniformly spaced using an increment of 65535.0/(M-1). For the input and output tables, M is the number of entries in the table. For the grid tables, M is the number of grid points along each dimension. Note that since the increment of 65535.0/(M-1)

is not necessarily an integer, the domain is specified to be over the real numbers rather than restricting it to the integers only.

The range of a function used to generate the contents of a table is likewise defined to be all real numbers between 0.0 and 65535.0, inclusive. Because the contents of a table are encoded using 16 bits of precision, it is necessary to round each real value to the nearest 16-bit integer.

This means that both the domain and range of the functions represented by the elements of the lut16Type as a whole are all real numbers between 0.0 and 65535.0, inclusive. In many situations it is necessary to convert between these 16-bit values and some other bit precision.

See Annex A, "Color Spaces" for additional guidance on this topic.

The PCS color space of a lut16Type tag (which may be either the input or output space) is identified by the Profile Connection Space Signature field (bytes 20-23) in the profile header. This field does not distinguish between 8-bit and 16-bit PCS encodings. For the lut16Type tag, the ’Lab ’ signature is defined to specify the 16-bit CIELAB encoding and the ’XYZ ’ signature is defined to specify the 16-bit XYZ encoding. Note that this definition only applies to the use of these signatures when the color space is also the PCS.

Add the following to clause 6.5.7 (lut8Type tag):

The input, output, and grid tables contained in a lut8Type each embodies a one or multi-dimensional function which maps an input value in the "domain" of the function to an output value in the "range" of the function.

The domain of each of these tables is defined to consist of all real numbers between 0.0 and 255.0, inclusive. The first entry is located at 0.0, the last entry at 255.0, and intermediate entries are uniformly spaced using an increment of 255.0/(M-1). For the input and output tables, M is 256. For the grid tables, M is the number of grid points along each dimension. Note that since the increment of 255.0/(M-1) is not necessarily an integer, the domain is specified to be over the real numbers rather than restricting it to the integers only. The range of a function used to generate the contents of a table is likewise defined to be all real numbers between 0.0 and 255.0, inclusive.

Because the contents of a table are encoded using 8 bits of precision, it is necessary to round each real value to the nearest 8-bit integer. This means that both the domain and range of the functions represented by the elements of the lut8Type as a whole are all real numbers between 0.0 and 255.0, inclusive. In many situations it is necessary to convert between these 8-bit values and some other bit precision.

See Annex A, "Color Spaces" for additional guidance on this topic.

The PCS color space of a lut8Type tag (which may be either the input or output space) is identified by the Profile Connection Space Signature field (bytes 20-23) in the profile header. This field does not distinguish between 8-bit and 16-bit PCS encodings. For the lut8Type tag, the ’Lab ’ signature is defined to specify the 8-bit CIELAB encoding. Note that this definition only applies to the use of these signatures when the color space is also the PCS.

An 8-bit XYZ PCS has not been defined, so the interpretation of a lut8Type in a profile that uses the XYZ PCS is implementation specific. Because of the resulting ambiguity and because an 8-bit linear quantization of XYZ results in poor quality it is recommended that the lut8Type tag not be used in profiles that employ the XYZ PCS.

Add the following to Annex A ("Color Spaces"):

CMMs or other applications that use ICC tags to perform color transformations typically need to perform two types of data processing in addition to table interpolation. First, because the color values being processed (such as image pixels) may not match the native precision of an ICC tag (such as a lut16Type or lut8Type), it may be necessary to alter the precision of the input to or results from these transforms. Second, because there is more than one PCS encoding, it may be necessary to convert the output from a first transform before applying it to the input of a second transform. These two types of additional processing may be thought of as primarily affecting the external and internal interfaces of ICC processing, respectively.

In the first, or external, case the appropriate conversion method is to multiply each color value by (2^M-1)/(2^N-1), where N is the starting number of bits and M is the required number of bits. This converts a number with values from 0 to 2^N-1 to a number with values from 0 to 2^M-1. For example, to prepare

In the first, or external, case the appropriate conversion method is to multiply each color value by (2^M-1)/(2^N-1), where N is the starting number of bits and M is the required number of bits. This converts a number with values from 0 to 2^N-1 to a number with values from 0 to 2^M-1. For example, to prepare an 8-bit image value for input to a lut16Type tag the scale factor is (2^16-1)/(2^8-1) = 65535.0/255.0 = 257.0. Note that the colors represented by the scaled numbers (be they device coordinates or some other color space) are not altered by the change in precision. For example, if a particular image value represents an L* of 31.0, then the scaled value ALSO represents an L* of 31.0. Additionally, if an integer value is required from the scaling operation, it should be obtained via rounding rather than truncation.

In the second, or internal, case the appropriate conversion uses the CIE equations to convert between CIEXYZ and CIELAB. Additionally, special attention should be paid to the colors representable by the 8- and 16-bit PCS encodings - they are not the same! For example, conversion from the 8-bit encodings to the 16-bit encodings requires a scale factor of (65280.0 {16-bit L* of 100}) / (255.0 {8-bit L* of 100}) = 256.0 rather than 257.0 as is appropriate for the image values case described above. This is because both the precision and the representable extremes of the color gamut of the encodings are different.

1.3 Addition of chromaticityTag (as an optional Tag)

This is from ballot #199908, effective 1998-03-25.

Profiles conforming to these rules use a Profile Version number of 2.3.0 (see ICC.1:1998-09, clause 6.1.3).

Add the following new Tag into 6.4 Tag Description:

Tag Name	General Description
chromaticityTag	Set of phosphor/colorant chromaticity

6.4.X chromaticityTag
Tag Type: chromaticityType
Tag Signature: ‘chrm’ (6368726dh)

The data and type of phosphor/colorant chromaticity set.

Add the following new Tag Type into 6.5 Tag Type Definitions:

6.5.X chromaticityType

The chromaticityType information provides basic chromaticity data and phosphors or colorants type of a monitor to applications and utilities. The byte stream is given by below.

Byte Offset	Content	Encoded as...
0-3	’chrm’(6368726dh) type descriptor	
4-7	reserved, must be set to 0	
8-9	Number of Device Channels	uInt16Number
10-11	encoded value of phosphor or colorant type	see below
12-19	xy coordinate values of channel 1	u16Fixed16Number[2]
20-x	xy coordinate values of channel 2	u16Fixed16Number[2]
x+1 - y	xy coordinate values of channel 3	u16Fixed16Number[2]

TABLE XX

(- note - More xy coordinate should be added if the display has more than three channels)

When using this type, it is necessary to assign each color space component to device channel. TABLE 49 (or 51) shows these assignments. The channels are numbered according to the order in which their table occurs.

The encoding for the phosphor or colorant type field is such that

Phosphor or Colorant type	Encoded Value	Channel 1	Channel 2	Channel 3
unknown	0000h	any	any	any
ITU-R BT.709	0001h	(0.640, 0.330)	(0.300, 0.600)	(0.150, 0.060)
SMPTE RP145-1994	0002h	(0.64, 0.33)	(0.29, 0.60)	(0.15, 0.06)
EBU Tech.3213-E	0003h	(0.630, 0.340)	(0.310, 0.595)	(0.155, 0.070)
P22	0004h	(0.625, 0.340)	(0.280, 0.595)	(0.155, 0.070)

TABLE XX

~~When the encoded value is “0000h”, phosphor chromaticity must be described after byte 12. It is important that chromaticities match the table if the type is not 0000h.~~

When the encoded value is 0000h, the actual set of chromaticity values must be desribed. Otherwise, the chromaticity values must match the table values for the given phosphor type.

(- note - More phosphor/colorant sets could be added if necessary.)

Add to the 2. Normative References:

2. Normative References

1. ITU-R BT. 709-2 Parameter values for the HDTV standards for production and international programme exchange
2. SMPTE RP 145-1994: SMPTE C Color Monitor Colorimetry
3. EBU Tech. 3213-E: EBU standard for chromaticity tolerances for studio monitors